

Wetland Mitigation Guidelines

DEPARTMENT OF THE ARMY

U.S. ARMY ENGINEER DISTRICT, LOUISVILLE

CORPS OF ENGINEERS

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Operations Division

Regulatory Branch (South)

WETLAND COMPENSATORY MITIGATION AND MONITORING PLAN GUIDELINES FOR KENTUCKY

I. BACKGROUND

The draft "Wetland Compensatory Mitigation and monitoring Plan Guidelines for Kentucky (Kentucky Guidelines)" was jointly prepared in 1993 by representatives from the Louisville District Corps of Engineers, Region 4 U.S. Fish and Wildlife Service, Region 4 U.S. Environmental Protection Agency, the Kentucky Division of Water, and the Kentucky Department of Fish and Wildlife Resources. It has recently been revised in a cooperative effort with resource agencies, consultants, and representatives from regulated industries.

We strongly recommend that applicants follow the Kentucky Guidelines format when developing wetland compensatory mitigation and monitoring plans. A well developed mitigation plan will expedite the interagency review process, and minimize permit processing times. We also recommend that an applicant consider a pre-application meeting to determine the level and type of compensatory mitigation which may ultimately be required for a particular project. many times, this is dependent on the size and complexity of the project.

II. PURPOSE OF GUIDELINES

These Kentucky Guidelines are designed to assist applicants in the preparation and development of compensatory mitigation and monitoring plans associated with projects requiring Department of the Army (Corps) permits and Kentucky water quality certification. These guidelines will serve to provide consistency in the permit application evaluation process.

Submission of compensation and monitoring plans, as described in these Kentucky Guidelines, will not be a substitute for compliance with the "Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation under the Clean Water Act Section 404 (b) (1) Guidelines" effective February 6, 1990. Therefore, compensatory mitigation proposals will only be considered after avoidance and minimization have been fully pursued by the applicant.

The Kentucky Guidelines will be furnished to the applicant early in the permit application process to ensure that the applicant is aware of compensation and monitoring components that may be related to the successful

completion of the permit application evaluation process. Although individual components may not be applicable to every project, a compensatory mitigation proposal should address each heading in the Kentucky Guidelines.

III. SUBMITTAL OF COMPENSATORY MITIGATION PLAN.

A. Individual Permit

An applicant applying for an individual permit may include with the application a mitigation proposal for wetland compensation to offset unavoidable wetland impacts. A proposed draft compensatory mitigation and monitoring plan submitted with the Department of the Army permit application materials will be included in the public notice. A final compensatory mitigation plan should generally not be completed until a wetland jurisdictional determination has been accepted by the Corps and the area of proposed wetland impact to be compensated for has been identified. The Corps will request the applicant to submit a detailed mitigation and monitoring plan when the Corps has made a preliminary determination of compliance with the Section 404 (b) (1) Guidelines, and the public comment period has ended. This compensatory mitigation and monitoring plan will then be submitted and coordinated with federal and state resource agencies for interagency review.

B. Nationwide Permit

An applicant may submit a compensatory mitigation and monitoring plan for any Department of the Army nationwide permit(s) requiring notification procedures, including all Pre- Discharge Notifications. We recommend early submittal of compensatory mitigation and monitoring plans to ensure timely processing of the nationwide permit request.

IV. FINAL SUBMISSION

The final submission of all compensatory mitigation and monitoring plans should be in a SINGLE document. The single document should contain up-to-date versions of all materials, even if other versions were submitted earlier in the process.

V. WETLAND COMPENSATION OBJECTIVE

Compensatory mitigation is generally required for unavoidable adverse wetland impacts which remain after all appropriate and practical minimization has been required. In general, the Corps' goal is to attain a no net loss of wetlands functions and values. The replacement ratio of wetlands functions and values (or acreage) required to achieve this goal are determined by the Corps on a case by case basis.

Restoration of prior converted cropland sites (PC) are preferred for applicants requiring compensatory mitigation for impacting bottomland hardwoods. These Kentucky Guidelines reflect requirements for PC sites, farmed wetland (FW) sites, and creation (C) sites. A review of permits issued over the last several years indicates that wetland mitigation for PC sites generally exceeds a ratio of 2: 1. The use of FW sites, and creation of wetlands in non-hydric soils (C sites) generally have replacement ratios which exceed a 3:1 ratio. Generally, a minimal amount of technical data will be required for restoring PC sites because of the higher probability of success. Conversely, creation sites could require extensive detailed data due to the uncertainties of establishing the proper hydrology and soil conditions required for wetland success.

Mitigation for wetlands other than bottomland hardwoods generally involves creation of permanently inundated areas from upland areas. Mitigation ratios on these areas are best addressed on a case-by-case basis during the pre-application process.

VI. COMPLIANCE ASSURANCES

An applicant may be required to obtain a letter of credit or a performance bond tied to the attainment of agreed upon final success criteria.

VI. MITIGATION BANKING

Mitigation banking is defined as wetland restoration, creation, enhancement, and in exceptional circumstances, preservation undertaken expressly for the purpose of compensating for unavoidable wetland losses. Mitigation banking occurs **IN ADVANCE** of development actions, when such compensation cannot be achieved at the development site, or would not be as environmentally beneficial. Guidance on mitigation banking was published in the November 28, 1995 Federal Register under the title "FEDERAL GUIDANCE FOR THE ESTABLISHMENT, USE AND OPERATION OF MITIGATION BANKS"

VIII. PERSONS TO CONTACT WITH QUESTIONS

If you have any questions regarding these guidelines, please contact the U.S. Army Corps of Engineers Regulatory Branch at (502)315-6733 or (502)315-6686.

WETLAND COMPENSATORY MITIGATION

AND

MONITORING PLAN

GUIDELINES FOR KENTUCKY

US Army Corps of Engineers

Louisville District

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CHAPTER 1. DEVELOPMENT SITE DESCRIPTION

- I. Introduction
 - A. Brief summary of overall proposed project and purpose
 - B. Impacted wetland acreage
 - 1. Primary
 - 2. Secondary
- II. Location
 - A. Narrative description
 - 1. Local (i.e., directions to the site using road names, highway numbers and mileage distances)
 - 2. Relative geographic location within watershed (e.g., headwater, stream order, floodplain, isolated, etc.)
 - 3. Surrounding land use
 - a. Percentage of land use types(s) occurring within at least a 1000 ft band around the wetland area.
 - b. Significant land use(s) within watershed which would affect the hydrological inputs or be affected by the hydrological outflows from the wetland
 - 4. Proximity to existing wetlands
 - a. National Wetlands Inventory Map
 - b. Field observations
 - B. Maps (8 1/2" x 11")
 - 1. County road map with proposed development site clearly outlined
 - 2. USGS quadrangle map with proposed development site clearly outlined
 - 3. Existing conditions (See appendix A)
 - 4. National Wetlands Inventory Map
 - 5. Aerial Photography, if available
- III. Identification of responsible parties (names[s], titles[s], address[es], and phone number[s])
 - A. Applicant(s)
 - B. Contact person(s) if applicant is a company
 - C. Consultant or preparers of compensatory mitigation plan (include resume with references)

IV. Site characterization

A. Wetland classification (Cowardin et al, 1979) (Brinson 1993)

B. Wetland functions and values (Narrative based on checklist in Appendix B) (Include copies of completed checklist(s))

1. Hydrology (surface and groundwater)
2. Biogeochemical processes
3. Plant maintenance (see [Appendix B](#))
4. Habitat maintenance (see [Appendix B](#))

C. Soils

1. Soils series and description
2. Field characteristics (soil color, texture, composition, percent of organic material and other hydric soil indicators)

D. Vegetation (Refer to wetland delineation)

1. Species composition and indicator status by stratum (overstory, understory, herbaceous) (list by scientific and common names)
2. Community structure
3. Dominant species for each stratum
4. Zonation (if present)

E. Hydrology (Utilizing best available data)

1. Surface Water
 - a. Hydroperiod
 - i. Gage data
 - ii. Documented observation
 - iii. SCS county soil survey
 - iv. Wetland delineation hydrologic data/indicators
 - v. Flow conditions (hydrodynamics)
 - b. Source
 - i. Overbank flooding
 - ii. Precipitation
 - iii. Groundwater seeps
 - iv. Location and types of inflows and outflows
2. Seasonal Groundwater table elevations/fluctuations
 - a. SCS county soil survey
 - b. Other published data (e.g. KY Division of Water)
 - c. Wetland delineation hydrology data/indicators

CHAPTER 2. PROPOSED COMPENSATORY MITIGATION SITE DESCRIPTION

I. Location

A. Narrative description

1. Local (i.e., directions to the site using road names, highway numbers and mileage distances)
2. Relative geographic location within watershed (e.g., headwater, stream order, floodplain, isolated, etc.)
3. Surrounding land use(s)
 - a. Percentage of land use type(s) occurring within at least a 1000 ft band around the wetland area
 - b. Significant land use(s) within watershed which would affect the hydrological inputs or be affected by the hydrological outflows from the wetland
4. Proximity to existing wetlands
 - a. National Wetlands Inventory Map
 - b. Field observations

B. Maps (8 1/2 " x 11 ")

1. County road map with proposed compensatory mitigation site clearly outlined
2. USGS quadrangle map with proposed compensatory mitigation site clearly outlined
3. National Wetlands Inventory
4. Existing conditions (See [Appendix A](#))
5. Proposed conditions (See [Appendix A](#))
6. Aerial photography, if available

II. Proposed wetland classification (if out-of-kind, present rationale)

A. Cowardin classification (Cowardin et al, 1979)

B. Hydrogeomorphic classification (Brinson 1993)

C. Natural Resources Conservation Service (NRCS) Mapping Conventions (if applicable)

III. Functions and values (Narrative based on checklist in [Appendix B](#))

A. Existing

1. Hydrology
2. Biogeochemical processes
3. Plant maintenance
4. Habitat maintenance
5. Watershed map (See [Appendix A](#))

B. Proposed

1. Hydrology
2. Biogeochemical processes
3. Plant maintenance
4. Habitat maintenance
5. Watershed map (See [Appendix A](#))

IV. Soils

A. Soils series and description

B. Analytical data such as saturated hydraulic conductivity and redox potential

C. Soil analyses

1. Nutrients
2. Texture
3. Organic matter content

V. Proposed vegetation

A. Species composition and indicator status (list by scientific and common names)

(See [Appendix C](#) for recommended species)

1. Overstory composition (minimum of 4 species recommended)
2. Understory composition (minimum of 3 species recommended)*
3. Herbaceous composition (minimum of 5 species recommended)*
4. Species predicted to invade naturally

* Understory and herbaceous species may not need to be planted if a good seed source is available

B. Community structure

1. Dominant species for each stratum
2. Zonation (if applicable)

C. Planting

1. Rates (e.g. 1000/acre for direct seeding)
 - a. Wildlife objectives - 194/acre accomplished by 15 X 15 foot spacing
 - b. Timber production - 437/acre accomplished by 10 X 10 foot spacing
2. No single species comprising significantly more than 25% of total
 1. Concentrate on heavy masted species (e.g. oak and hickory) - light masted species (e.g. maple and ash) are expected to invade most sites naturally.
2. Stock description and origin (e.g. acorn, bare root stock, balled & burlap, container grown)

II. Hydrology

A. Existing

1. Surface water

- a. Hydroperiod
- b. Source
 - i. Overbank flooding
 - ii. Precipitation
 - iii. Groundwater seeps
- c. Hydrodynamics

2. Groundwater

- a. Seasonal table elevations
 - i. Soil survey
 - ii. Well data (if available)
- b. Low flow level in adjacent stream (if applicable)

B. Proposed

1. Surface water

- a. Hydroperiod
- b. Source
 - i. Overbank flooding
 - ii. Precipitation
 - iii. Groundwater seeps
 - iv. Hydrodynamics

2. Groundwater

- a. Seasonal table elevations
- b. Low flow level in adjacent stream channel (if applicable)

CHAPTER 3. SUCCESS CRITERIA & PERFORMANCE STANDARDS

- I. Construction schedule - construction should be completed prior to or concurrently with project completion.
- II. Soils parameters (if necessary) will be used to provide supportive evidence of success but will not carry minimum requirements.
 - A. Soils redox - Exhibits anaerobic conditions for 5 to 12 1/2% of the growing season (or as defined in the current wetland delineation manual). Provide statistical proof that sample data falls within success criteria.
 - B. Organic matter - should exhibit an increase over time
- III. Vegetation
 - A. Mean density per acre meets that proposed based on compensatory mitigation objectives and composed of at least 50% approved planted species, which have been established on-site for five consecutive successful years.
 - B. No single species constitutes significantly more than 25% of the surviving species.
 - C. Meets current federal delineation manual for hydrophytic vegetation.
 - D. Meets proposed Cowardin classification (see Chapter 3.I.C.4)
- IV. Hydrology - hydroperiod is restored as defined in Chapter 2, Section VI.B.; at a minimum the site is inundated and/or saturated for 5 to 12 1/2% of the growing season (or as defined in the current wetland delineation manual). Provide statistical proof that sample data falls within success criteria.
- V. Water quality
 - A. Meets Kentucky Water Quality Standards
 - B. Will be site specific and based on compensatory mitigation objectives.
- VI. Functions and values of the compensatory mitigation site are comparable to those identified from the development site (see checklist - [Appendix B](#)).
 - A. Hydrology
 - B. Biogeochemical processes
 - C. Plant maintenance
 - D. Habitat maintenance

CHAPTER 4. MONITORING

I. Parameters

A. Construction schedule

1. Duration of compensatory mitigation
2. Plan showing each phase of the compensatory mitigation and the proposed dates of initiation and completion, e.g. earth moving, hydrology restoration, revegetation, and monitoring phases. (Deviations from projected dates will need to be pre-approved by the regulatory agencies)

B. Soils*

1. Redox potential
2. Organic matter content
3. Nutrients

C. Vegetation*

1. Species composition and indicator status (list by scientific and common names)
2. Survival rate of planted species
3. Ratio of planted species vs. volunteer species
4. Individual species importance values

D. Hydrology*

1. Surface water hydroperiod
 - a. Source
 - i. Precipitation
 - ii. Overbank flooding
 - b. Depth(s)
 - c. Frequency
 - d. Duration of inundation
2. Seasonal groundwater table elevations

E. Water quality* (site specific and based on compensatory mitigation objectives)

F. Functions and values (Narrative based on checklist in [Appendix B](#))

1. Hydrology
2. Biogeochemical processes
3. Plant maintenance
4. Habitat maintenance

II. Sampling frequency

- A. If necessary, sample soils redox potential at frequency sufficient to demonstrate the site exhibits anaerobic conditions for 5 to 12 1/2 % of the growing season (or as defined in the current wetland delineation manual).
- B. Sample vegetation (woody layer and herbaceous layer) once in late summer or early fall until there have been two consecutive successful years (See Chapter 4 for Success Criteria); afterwards sample once in early fall for the remainder of the monitoring period.
- C. Hydrology
 - 1. Record surface water during each inundation event during the growing season (e.g. USGS data/cork staff gage).
 - 2. Record groundwater every 9 days from March 15 through June 30 and monthly the remainder of the growing season.
- D. Water Quality sampling frequency will be determined on a site specific basis.
- E. Complete the function and values checklist ([Appendix B](#)) annually in the Spring.

III. Monitoring reports

- A. Report format should follow guidelines format.
- B. Should include interpretation of data as performed by a qualified individual.
- C. Results and discussions should address each item included within these guidelines.
- D. Submit reports biannually until there have been two consecutive years of successfully meeting performance criteria; submit annually thereafter.
- E. Photographic documentation should be included of wetland and surrounding landscape(s) from all four cardinal directions using 35 mm color film from permanent photo stations (these photo stations need to be depicted on plan view sheets to promote consistency from one monitoring session to the next).
- F. List names, addresses, and phone numbers of persons/entities responsible for each type of sampling and report preparation.

-- Follow standard sampling methods and provide specific citation for each. If alternative methods are selected, describe and reference for approval by the regulatory agencies. Characterize the compensatory mitigation site by using an adequate number of sample sites and locations. Ensure validity of sampling results through standard statistical methods.

CHAPTER 5. CONTINGENCY PLAN

- I. Reporting Protocol - If a success criteria is not met for all or any portion of the compensatory mitigation project in any year, and/or if the final success criteria are not satisfied, the permittee shall prepare an analysis of the cause(s) of failure and, if determined necessary by the regulatory agencies, propose remedial action for pre-approval.
- II. Alternative locations for contingency compensatory mitigation-indicate specific alternative compensatory mitigation locations that may be used in the event that compensatory mitigation cannot be successfully achieved at the intended site.

CHAPTER 6. PERMANENT PROTECTION MEASURES

- I. To insure permanent protection, transfer of ownership of the compensatory mitigation site to non-profit environmental organization or resource management agency is recommended.
- II. Provide proposal for protection of all compensatory mitigation lands, in perpetuity, as functional wetlands in accordance with the compensatory mitigation plan.
- III. Provide cop(ies) of all written agreements with land owner clearly describing compensatory mitigation site and restrictions.
- IV. Provide copy of official deed showing compensatory mitigation site and restrictions binding on current and all future owners.
- V. Provide copy of long term management plan ensuring the maintenance of compensatory mitigation site in accordance with compensatory mitigation objectives.

APPENDIX A: MAPS, PLANS, AND DRAWINGS

- I. Existing conditions (or in case of violation site - pre-existing conditions as available) of development site and proposed compensatory mitigation site
 - A. Plan view sheets (Scale: 1 inch = 400 feet)
 1. Soil types
 2. Hydrological conditions including 1 foot contours
 3. Vegetative distribution patterns
 4. Location and contours of drainage ditches, levees, berms, and spoil piles
 5. Surrounding land use(s)
 - B. Cross sectional profiles(s)
 1. Width, depth, and bottom elevation of ditches
 2. Height and width of berms, levees, and spoil areas
- II. Proposed restored compensatory mitigation site conditions
 - A. Plan view sheets (Scale: 1 inch = 400 feet)
 1. Monitoring stations, e.g. groundwater wells, staff gauges, etc
 2. Soil types and depth used for areas without adequate hydric soils initially (primarily for creation)
 3. Proposed vegetation planting composition, planting rates, and species distribution patterns
 4. Hydrology restoration measures including 1 foot contours; elevations, ditch checks, berms, levee breeches, etc.
 5. Sediment and erosion control, e.g. location of check dams, straw bales, etc.
 6. Earth moving and, if applicable, disposal area used for excess material.
 7. Surrounding land use(s)
 - B. Cross sectional profiles(s)
 1. Width, depth, and bottom elevation of ditches
 2. Height and width of berms, levees, and spoil areas
- III. As-Built Plans - should be signed by a certified professional engineer and submitted to the Army Corps of Engineers within 60 days after compensatory mitigation project completion.

APPENDIX B: FUNCTIONS AND VALUES CHECKLIST

The assessment of function for mitigation sites should be based upon the Hydrogeomorphic Classification System for Wetlands (Brinson 1993). This classification is based upon three basic properties which provide insight into wetland function. These three basic properties are: geomorphic setting (riverine, depressional, fringe); water source (precipitation, lateral flows from upstream or upslope, and ground water); and hydrodynamics (vertical, unidirectional and horizontal, and bidirectional and horizontal). To determine the relative potential for a mitigated wetland to achieve similar hydrogeomorphic functions as a project site, selected reference wetland (or selected reference population), and therefore achieve success, the sites must be compared hydrogeomorphically. The mitigation site must be of a similar hydrogeomorphic class (i.e. have a similar hydrogeomorphic setting; water source; and hydrodynamics) to the project site to approach a successful mitigation project from a functional standpoint. It is important to note that "success" in this context refers to ecological replacement of functions lost due to development of a particular wetland site.

The following represent categories of function attributed to riverine and depressional wetlands. As further work on wetland systems is completed certain categories of function may be deleted or added as new information is available.

Riverine wetland functions:

Hydrology -

Dynamic surface water storage [DSWS] - Capability of a wetland to detain moving water from overbank flow for a short duration when flow is out of the channel; associated with moving water from overbank flow and/or upland surface water inputs by overland flow or tributaries.

Long term surface water storage [LTS]- Capability of wetland to store (detain) surface water for long durations; associated with standing water not moving over the surface. Sources of water may be overbank flow, channel flow, and/or subsurface flow. Storage is associated with standing water.

Energy dissipation [ED]- Allocation of the energy of water to other forms as it moves through, into, or out of the wetland as a result of roughness associated with large woody debris, vegetation structure, micro- and macrotopography, and other obstructions.

Subsurface water storage [SWS]- Availability of water storage beneath the wetland surface. Storage capacity becomes available as periodic drawdown of water table or reduction in soil saturation occurs.

Moderation of groundwater flow or discharge [MGWF]- Capacity of a wetland to moderate (slow) the rate of groundwater flow or discharge from upgradient (i.e. upstream) or upslope (i.e.lateral) sources.

Biogeochemical Processes -

Nutrient cycling [NC]- Abiotic and biotic processes that convert elements from one form to another; primarily recycling processes.

Removal of imported elements and compounds [REC]- The removal of imported nutrients, contaminants, and other elements and compounds.

Retention of particulates [RP]- Deposition and retention of inorganic and organic particulates from the water column (>0.45 um including coarse woody debris) primarily through physical processes.

Organic carbon export [OCE]- Export of dissolved and particulate organic carbon from the wetland. Mechanisms include leaching, flushing, displacement, and erosion.

Plant Maintenance -

Maintain characteristic plant community [MCPC]- Species composition and physical characteristics of living plant biomass. The emphasis is on the dynamics and structure of the plant community as revealed by the dominant species of trees, shrubs, seedlings, saplings, and ground cover, and by the physical characteristics of vegetation.

Maintain characteristic detrital biomass [DB]- The processes of production, accumulation, and dispersal of dead plant biomass. Sources of organic matter may be onsite, upslope/upgradient areas, or backwater.

Habitat Maintenance -

Maintain spatial structure of habitat [MSSH]- The capacity of a wetland to support animal populations and guilds by providing heterogenous habitats.

Maintain habitat interspersion and connectivity [MIC]- The capacity of a wetland to permit aquatic organisms to enter and leave the wetland via permanent or ephemeral surface channels, overbank flow, or unconfined hyporheic gravel aquifers. The capacity of the wetland to permit access of terrestrial or aerial organisms to contiguous areas of food and cover.

Maintain distribution and abundance of invertebrates [MDAI]- The capacity of a wetland to maintain characteristic density and spatial distribution of invertebrates (aquatic, semi-aquatic, and terrestrial).

Maintain distribution and abundance of vertebrates [MDAV]-The capacity of a wetland to maintain the density and spatial distribution of vertebrates (aquatic, semi-aquatic, and terrestrial) that utilize wetlands for food, cover, rest, and reproduction.

Depressional wetland functions:

Hydrology -

Surface water storage [DPSWS] - Capability of wetland to store or detain precipitation. The predominant water source is precipitation, however some overland flow may originate from adjacent areas of higher elevation.

Subsurface storage of water [DPSSW] - Capacity to store water below the wetland surface.

Biogeochemical -

Nutrient transformations and processing [NTP] - Abiotic and biotic processes that convert elements from one form to another; primarily recycling processes. Growth or biomass accumulation and decomposition ensures that elements are converted between organic and inorganic forms.

Removal of elements and compounds in precipitation and dryfall [REC] - The removal of nutrients, compounds, and dryfall imported directly by precipitation or by overland flow from adjacent areas. This

differs from the NUTRIENT TRANSFORMATIONS AND PROCESSING function where the emphasis is on interconversions and recycling on less than an annual time scale. Retention of elements and compounds is the removal from cycling on a more or less permanent basis by one or several of the following:

- 1) Loss to the atmosphere - occurs as nitrate is denitrified to N₂ or N₂O, ammonia is volatilized, and sulfur is converted to gaseous form;
- 2) Deposition and burial in sediments - occurs through burial, precipitation (removal of phosphorous by iron III, sorption (heavy metals with organic matter), and others.
- 3) Assimilation into biomass by storage in perennial plant parts of herbaceous species and storage in long-lasting woody biomass.

Organic carbon export [DPOCE] - Export of dissolved and particulate organic carbon from the wetland through leaching, flushing, displacement, and erosion.

Depressional wetlands also function to maintain characteristic plant communities, detrital biomass, vertical habitat structure, and food web support for animals. These functions are the same as those characterized for riverine wetlands and utilize the same indicators.

Brinson (1993) also discussed indicators of function as derivatives of the three basic properties of wetlands (geomorphic setting, water source and hydrodynamics). These indicators entail short-term (e.g. high water marks, herbaceous plant cover, debris wracks) and long-term (e.g. geomorphic structure, forest canopy species composition) indicators of wetland function and processing. The following list represents those indicators of function which can be detected on mitigation sites within a short time frame and can be used as indicators of functional replacement.

Checklists should be completed annually and submitted to the Corps for analysis. However, many of these indicators are temporal in nature (i.e. occur only in spring season when water is on the sites) and notes should be taken during other monitoring visits to document the presence of any of these indicators. Direct observation of any function (e.g. observation of ponded water during the growing season, groundwater within 12 inches of the surface) should be documented whenever possible. Indicators on the checklist are marked only as being present or absent. However, observations quantifying any indicator (i.e. depth of water on the site, percent of site covered by water, depth to saturation, percent cover, zonation of surface or groundwater patterns, etc.) should be included whenever possible. This information will assist the Corps and other resource agencies in assessing the ecological development of the mitigation site.

Finally, this constitutes a preliminary list of indicators of function. Once the mitigation and monitoring commences additional signs of ecological function may be observed that are not on this list. These observations should be documented and their ecological significance discussed. It is anticipated that such observations may add a great deal of pertinent information to the resource agencies in assessing the mitigation site's success.

Indicators of function

---- Microtopographic relief (e.g. hummocks, scour around trees, small surface channels)
[Microtopographic relief occurs on the order of a few meters or less, such as pit-and-mound features from windthrow, hummocks, buttressing of trees, large logs, etc.]

---- Overbank flooding (direct observation or indirect evidence such as water, aerial photographs, or gage data)

- Sediment scour and deposition
- Redistribution of detritus (e.g. wrack, debris jams, drift lines)
- Localized sediment deposition
- Structural roughness (e.g. vegetation, microtopographic relief)
- Presence of debris jams and wrack
- Intermediate soil porosity

Sediments must be capable of developing unsaturated pore space in order to have the capacity to store water. (Fine grained soils with low transmissivity function poorly in subsurface storage of water because of their resistance to infiltration and because they maintain thick capillary fringes that don't develop adequate unsaturated volume for subsurface storage).

---- Reduced soil conditions (e.g. mottling, gleying, organic matter accumulation, redox potential, etc.)
Contributes to the maintenance of hydric soils, anaerobic biogeochemistry, and plant and animal species composition adapted to life in reduced conditions.

---- Saturated soils unrelated to overbank flooding (i.e. maintained in spite of the lack of precipitation and overbank flooding) Groundwater discharge originating upslope may maintain saturation when other supplies cease.

---- Seeps at upland/wetland interface, or at surface of wetland (Such seeps are indicative of water moving vertically upward)

---- Floodplain ponding (direct observation or indirect evidence)

---- Sparse herbaceous growth in depressions

---- Low permeability soils

---- Vegetation indicative of standing water (For example: submerged aquatic and/or obligate emergents)

---- Vegetative community (density, basal area, vertical stratification, cover and species composition) typical of reference site with evidence of nutrient uptake and release (plant growth, litter production, decomposition rate, etc.)

---- Surface films or layers of recently deposited sediments

---- Debris blockages in active channels; blockages in side channels; accumulations in microtopographic depressions; accumulations in vegetation; redistribution off-site

INDICATOR CHECKLIST

<u>INDICATOR</u>	<u>PRESENT</u>	<u>ABSENT</u>
Microtopographic relief		
Overbank flooding		
Sediment scour and deposition		
Redistribution of detritus		
Localized sediment deposition		
Structural roughness		
Presence of debris dams and wrack		
Intermediate soil porosity		
Reduced soil conditions		
Low permeability soils		
Saturated soils unrelated to overbank flow		
Seeps at upland/wetland interface, or at wetland surface		
Floodplain ponding		
Sparse herbaceous growth in depressions		
Submerged aquatic vegetation		
Obligate wetland vegetation dominates		
Vegetative community typical of "reference" (impact) site		
Surface films or layers of recently deposited sediments		
Debris dams in active channels		
Debris dams in side channels		
Debris accumulations in microtopographic depressions		
Debris accumulations in vegetation		
Debris redistribution off-site		

APPENDIX C: WETLAND PLANT LIST

The compensatory mitigation site should be revegetated based upon vegetation surveys of reference wetlands in the area and known information about species tolerance to various wetland conditions. The following list contains common species occurring in three different water regimes, as classified by the National Wetland Inventory, of Kentucky's forested wetlands. It should be used as a guide to recommended species composition. Please note that the light masted species such as red maple, green ash, sycamore, river birch, and cottonwood designated by an "I" are expected to invade most sites naturally and do not need to be planted. (Species designated by an asterisk, "*", are preferred dominants.)

Common Name	Scientific Name
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PFO1A WETLANDS (Temporarily Flooded)

Overstory

Pin Oak*	<i>Quercus palustris</i>
Shellbark Hickory*	<i>Carya laciniosa</i>
Swamp Chestnut oak	<i>Quercus michauxii</i>
Cherrybark oak	<i>Quercus pagoda</i>
Bur oak	<i>Quercus macrocarpa</i>
Green Ash (I)	<i>Fraxinus pennsylvanica</i>
Red maple (I)	<i>Acer rubrum</i>
Sweetgum (I)	<i>Liquidambar styraciflua</i>
Sycamore (I)	<i>Platanus occidentalis</i>
Sugarberry	<i>Celtis laevigata</i>
Black gum	<i>Nyssa sylvatica</i>

Understory

Arrow-wood	<i>Viburnum dentatum</i>
Deciduous Holly	<i>Ilex decidua</i>
Gray Dogwood	<i>Cornus racemosa</i>
Silky Dogwood	<i>Cornus amomum</i>
American hornbeam	<i>Carpinus caroliniana</i>
Persimmon	<i>Diospyros virginiana</i>
Elderberry	<i>Sambucus canadensis</i>

Herbaceous

Jewelweed	<i>Impatiens</i> spp.
Sedges	<i>Carex</i> spp.
Spikerushes	<i>Elocharis</i> spp.
Flatsedges	<i>Cyperus</i> spp.
Nutsedge	<i>Cyperus strigosus</i>
Chufa	<i>Cyperus esculentus</i>
Clearweed	<i>Pilea pumila</i>

PFO1C WETLANDS (Seasonally Flooded)

Overstory

Pin Oak*	<i>Quercus palustris</i>
Shellbark Hickory*	<i>Carya laciniosa</i>
Overcup oak	<i>Quercus lyrata</i>
Swamp white oak	<i>Quercus bicolor</i>
American elm (I)	<i>Ulmus americana</i>
Swamp cottonwood	<i>Populus heterophylla</i>
Black gum	<i>Nyssa sylvatica</i>

Understory

Withe-rod	<i>Viburnum cassinoides</i>
Silky Dogwood	<i>Cornus amomum</i>
Sugarberry	<i>Celtis laevigata</i>
Persimmon	<i>Diospyros virginiana</i>
Spicebush	<i>Lindera benzoin</i>
Steeplebush	<i>Spiraea tomentosa</i>
Deciduous Holly	<i>Ilex decidua</i>

Herbaceous

Beggarticks	<i>Bidens</i> spp.
Bulrushes	<i>Scirpus</i> spp.
Sedges	<i>Carex</i> spp.
Spikerushes	<i>Eleocharis</i> spp.
Wild millet	<i>Echinochloa muricata</i>
Cutgrass	<i>Leersia</i> spp.

PFO1F WETLANDS (Semipermanently Flooded)

Overstory

Overcup oak*	<i>Quercus lyrata</i>
Swamp white oak*	<i>Quercus bicolor</i>
Water tupelo	<i>Nyssa aquatica</i>
Water hickory	<i>Carya aquatica</i>
Bald cypress	<i>Taxodium distichum</i>

Understory

Swamp Privet	<i>Forestiera acuminata</i>
Buttonbush	<i>Cephalanthus occidentalis</i>
Swamp-haw	<i>Viburnum nudum</i>
Winterberry	<i>Ilex verticillata</i>
Common Alder	<i>Alnus serrulata</i>
Swamp Rose	<i>Rosa palustris</i>

Herbaceous

Arrowhead	Sagittaria spp.
Lizard's tail	Saururus cernuus
Water-Plantain	Alisma subcordatum
Sweet flag	Acorus calamus
Spatterdock	Nuphar luteum
Bulrushes	Scirpus spp.
Sedges	Carex spp.
Cutgrass	Leersia spp.

The following species are recommended for establishing groundcover on wetland soils. The use of KY 31 fescue is prohibited.

Groundcover	Scientific name
Rice cutgrass	Leersia oryzoides
Managrass	Glyceria striata
Spangle grass	Chasmanthium latifolium
Redtop	Agrostis alba
Barnyard grass	Echinochloa crus-galli
Alsike clover	Trifolium hybridum
Switchgrass	Panicum virgatum
Annual rye	Secale cereale
Wild rye	Elymus virginicus
Deertongue grass	Panicum clandestinum
Panic grass	Panicum microcarpon